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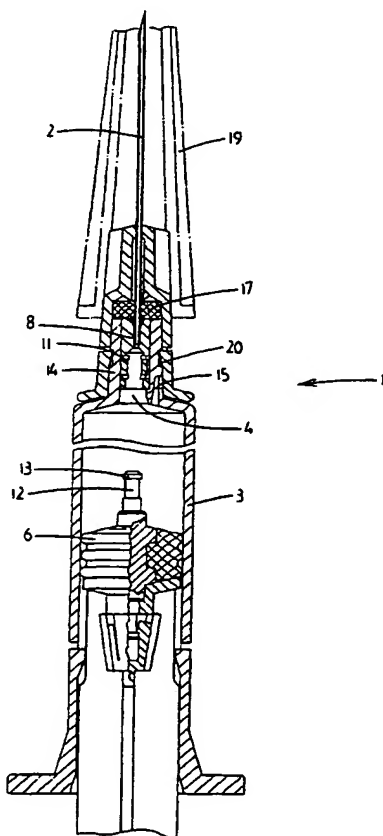
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(54) Title: INJECTION SYRINGE HAVING A RETRACTABLE INJECTION NEEDLE



(57) Abstract: The present invention relates to an injection syringe having a retractable injection needle, at least comprising: - a liquid holder having an outlet opening; - a plunger, which can be displaced inside the said liquid holder and has a plunger head, to which a plunger rod is or can be secured; - an injection needle with needle mount, which is or can be mounted in the outlet opening of the liquid holder; the needle mount of the injection needle and the plunger head comprising coupling means which are designed such that they can be coupled unambiguously to one another in order that, after the plunger head has been moved completely into the liquid holder in order to discharge liquid present in the liquid holder via the outlet opening, the injection needle, after the plunger head has been coupled to the needle mount of the injection needle, can be drawn into the liquid holder; the coupling means of the needle mount being designed in the form of a recess with an inwardly directed collar, and the coupling means of the plunger head being designed in the form of a projecting element with a thickened end; and the outlet opening of the liquid holder comprising a blocking means which is designed to block the needle mount in the outlet opening, which blocking means can be unblocked when the plunger head is coupled to the needle mount of the injection needle.

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Short title: Injection syringe having a retractable injection needle

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The present invention relates to an injection syringe having a retractable injection needle. Injection syringes of this type are known in practice. After the liquid which is present in the liquid holder of the injection syringe has been discharged, to enable the injection needle to be retracted, by way of example the plunger head of the plunger is coupled to the needle mount of the injection needle. As a result of the plunger then being moved back again, the injection needle can be drawn into the liquid holder of the injection syringe, so that it is possible to prevent the risk of injury from the injection needle. Moreover, this ensures that the injection syringe is not reused.

One drawback of the known injection syringes with a retractable injection needle is that the coupling means used are generally somewhat fragile.

Another drawback of the known injection syringe is that the injection needle, when the injection needle is being fitted to the outlet opening of the liquid holder, is difficult to position, i.e. in the known injection syringe the coupling means have to be positioned very accurately through the outlet opening of the liquid holder. If care is not taken during this operation, which in everyday practice is often the case, this may mean that the injection needle is not secured stably to the outlet opening of the liquid holder and/or that the coupling means will be damaged in some way, with the result that it is impossible to ensure that the injection needle will be safely retracted after the injection syringe has been used.

A further drawback of known injection syringes is that during coupling of the known coupling means, there is often what is known as a dead space, with the result that not all the liquid which is present in the liquid holder of the injection syringe can be discharged. This is particularly disadvantageous if an

expensive liquid is used.

Yet another drawback of known injection syringes is that, when the injection needle is secured to the outlet opening of the liquid container, it can inadvertently move into the liquid container.

A further significant drawback is that known injection syringes are often not liquid-tight and are therefore not free of leaks. This can lead to contamination and/or degradation of liquid which is present in the liquid holder, in particular if the injection syringes still have to be stored for a certain time in the filled state. In this context, it should be noted that in many injection syringes there is no fluid-tight connection between the injection needle and the liquid holder.

It is an object of the present invention to eliminate the above and further drawbacks.

Another object of the present invention is to provide a leak-free, liquid-tight injection syringe having a retractable injection needle which is easy to produce and is also simple to use.

It is another object of the present invention to provide a leak-free, liquid-tight injection syringe which can be produced with the minimum possible number of components and at the lowest possible costs.

These objects are achieved, by the present invention, by an injection syringe having a retractable injection needle, at least comprising:

- a liquid holder having an outlet opening;
 - a plunger, which can be displaced inside the said liquid holder and has a plunger head, to which a plunger rod is or can be secured;
 - an injection needle with needle mount, which is or can be mounted in or on the outlet opening of the liquid holder;
- the needle mount of the injection needle and the plunger head

comprising coupling means which are designed such that they can be coupled unambiguously to one another in order that, after the plunger head has been moved completely into the liquid holder in order to discharge liquid present in the liquid holder via the outlet opening, the injection needle, after the plunger head has been coupled to the needle mount of the injection needle, can be drawn into the liquid holder;

the coupling means of the needle mount being designed in the form of a recess with an inwardly directed collar, and the coupling means of the plunger head being designed in the form of a projecting element with a thickened end; and

the outlet opening of the liquid holder comprising a blocking means which is designed to block the needle mount in the outlet opening, which blocking means can be unblocked when the plunger head is coupled to the needle mount of the injection needle.

The liquid-tight, leak-free injection syringe having a retractable injection needle according to the invention is simple and inexpensive to produce on account of its simple structure and the small number of components.

A further advantage of the injection syringe according to the invention is that the injection needle is very easy to fit to the outlet opening of the liquid holder of the injection syringe, with the risk of damage to the coupling means of the needle mount and the piston head being substantially minimized.

Yet another advantage of the injection syringe according to the invention is that a coupling with "zero dead space" can be obtained, i.e. substantially all the liquid which is present in the liquid holder can also be discharged.

Yet another advantage of the injection syringe according to the invention is that when the injection needle is secured to the outlet opening of the liquid holder, the needle mount with injection needle can therefore only enter the liquid holder once the blocking means has been unblocked. The person skilled in the art will understand that the blocking means may be designed in various ways for this purpose, provided only that it is possible

to provide for unblocking after the liquid holder has been emptied.

The person skilled in the art will understand that the coupling
5 mechanism according to the present invention is not limited to a
"normal" injection syringe. The coupling mechanism according to
the present invention is also of value, for example, for use in
other types of injection syringes, such as for example prefilled
injection syringes, luer-lock syringes, etc., provided only that
10 the injection needle is retracted into the liquid holder after
the liquid holder has been emptied.

Furthermore, the person skilled in the art will understand that
the injection needle with needle mount can be mounted in or on
15 the outlet opening in various ways, provided that a reliable,
stable and liquid-tight securing method is provided. In this
context, it is preferable if the injection needle, after it has
been mounted in or on the outlet opening of the liquid holder,
can no longer be removed from the outlet opening, except by
20 being pulled inward into the liquid holder after the liquid
holder has been emptied.

In this context, it should be noted that FR 2 658 724 has
disclosed an injection syringe having a retractable injection
25 needle which is a very complicated design. However, FR 2 658 724
does not relate to a liquid-tight injection syringe in
accordance with the present invention.

According to the present invention, the term "liquid-tight" is
30 understood as meaning that when the injection syringe has been
assembled, it is impossible for any liquid to pass into or out
of the injection syringe except via the injection needle. In a
preferred embodiment of the invention, to this end the injection
syringe comprises a sealing material in the outlet opening, as
35 will be illustrated in more detail in the figures (sealing means
17 in Fig. 1).

When the injection syringe according to the invention is in use,
after the liquid holder has been emptied - as a result of the

plunger being moved toward the outlet opening - the plunger head and the needle mount of the injection needle will be coupled to one another and, at the same time, the needle mount of the injection needle will as a result be released from the outlet opening of the liquid holder. As a result of the plunger head then being moved back away from the outlet opening with the aid of the plunger rod, the needle mount with injection needle is as a result drawn into the liquid holder. A significant aspect of the injection syringe according to the invention is that the coupling is an "unambiguous" coupling, i.e. it is not effected by, for example, clamping or friction. This is because clamping based on friction may be insufficient for the needle mount with injection needle to be drawn back into the liquid holder after the liquid holder has been emptied.

The injection needle of the injection syringe according to the invention can be mounted in or on the outlet opening of the liquid holder both "through the inside" (i.e. via the end of the liquid holder which is remote from the outlet opening - cf. Fig. 1) and "around the outside" (i.e. as a result of the needle mount with injection needle being placed onto the outlet opening of the liquid holder - cf. Fig. 2). According to the present invention, however, it is preferable for it to be possible for the injection needle to be fitted "around the outside" (for example as shown in Fig. 2).

According to a preferred embodiment of the injection syringe according to the invention, the thickened end of the projecting element of the plunger head comprises an outwardly directed collar. This results in more reliable coupling between the needle mount and the projecting element of the plunger head, on account of the fact that the inwardly directed collar of the recess of the needle mount and the outwardly directed collar of the projecting element of the plunger head interact for this purpose, resulting in stable coupling.

The outlet opening of the liquid holder is advantageously designed in the form of a narrowed section. This narrowed section, which generally forms part of the liquid holder and in

this case, therefore, is fixedly connected thereto, ensures improved sealing - and therefore absence of leaks - for the injection syringe. The narrowed section may, for example, be in the form of a standard cone to which standard injection needles
5 can be fitted. For this purpose, the narrowed section may also, for example, be provided with a screw thread or the like.

It is preferable for at least the narrowed section, and even more preferably the entire liquid holder, to be made from a
10 rigid material, such as a rigid plastic, in order to improve the liquid-tightness of the injection syringe.

Making the narrowed section of the liquid container rigid provides the additional advantage - in addition to an improved
15 liquid-tightness - that as a result the liquid holder can be produced easily and at low cost, yet nevertheless dimensionally fixed and therefore stable positioning of the injection needle can be obtained.

20 According to a particularly preferred embodiment of the injection syringe according to the invention, the blocking means is designed in the form of one or more resilient projections which can yield in the direction of the wall of the liquid holder when the plunger head is pressed onto the outlet opening.
25 This ensures that, at the same time that the plunger head is coupled to the needle mount, the blocking means is also unblocked, so that it is possible to retract the needle mount together with injection needle.

30 Furthermore, it is advantageous if the needle mount is provided with one or more fingers which yield inward. These yielding fingers, separately or together, form an inwardly directed collar to which the projecting element of the plunger head can be coupled. This therefore provides unambiguous coupling of the
35 plunger head and needle mount.

The injection syringe advantageously comprises means for preventing rotation of the needle mount over the longitudinal axis of the liquid holder when the needle mount is mounted in or

on the outlet opening of the liquid holder. This prevents the injection needle from being able to rotate in the assembled state. As a result, during injection using the injection syringe according to the invention, it is possible to prevent a very
5 painful feeling in the person receiving the injection, which is particularly the case if - as is customary in the prior art - slightly curved injection needles are being used.

In a particularly simple embodiment of the injection syringe,
10 the rotation-preventing means are formed by a protruding projection on the needle mount which can be deformed when the plunger head is coupled to the needle mount, all this in such a manner that rotation of the needle mount on the longitudinal axis of the liquid container becomes possible again (after the
15 plunger head has been coupled to the needle mount). It is preferable for the projection to extend over substantially the entire length of the needle mount.

It is more preferable for the said means for preventing rotation
20 of the needle mount also to form the blocking means for blocking the needle mount in the outlet opening.

The present invention also relates to a needle mount which is clearly intended for the injection syringe according to the
25 invention.

Furthermore, the present invention relates to a plunger head which is clearly intended for the injection syringe according to the invention.
30

Finally, the present invention relates to a liquid holder which is clearly intended for the injection syringe according to the invention.

35 The present invention will be explained in more detail below with reference to the appended, non-limiting drawing, in which:

- Figure 1 shows a diagrammatic cross section through an injection syringe, assembled "through the inside", with

retractable injection needle in accordance with the invention;

- Figure 2 shows a diagrammatic cross section through an alternative embodiment of the injection syringe according to the invention, which is assembled "around the outside" and moreover
5 is provided with a protective cap;

- Figure 3 shows a diagrammatic cross section through the liquid holder of the injection syringe shown in Figure 2, on which the injection needle has not yet been mounted;

- Figure 4 shows a perspective view of a preferred embodiment
10 of the needle mount according to the invention;

- Figure 5 shows a diagrammatic cross section through a further alternative embodiment of the injection syringe according to the invention;

- Figure 6 shows a partial view of the narrowed section of
15 the liquid holder of the injection syringe shown in Fig. 5;

- Figure 7 shows a cross section through the narrowed section in Fig. 6;

- Figure 8 shows a diagrammatic cross section through yet another embodiment of the injection syringe according to the
20 invention; and

- Figure 9 shows a cross section through the narrowed section in Fig. 8.

Figure 1 shows a liquid-tight injection syringe 1 having a
25 retractable injection needle 2 in accordance with the present invention. The injection syringe 1 comprises a liquid holder 3 having an outlet opening 4. In the liquid holder 3 there is a displaceable plunger 5 with a plunger head 6 to which a plunger rod 7 is secured. The injection needle 2 with needle mount 8 is
30 secured in the outlet opening 4 of the liquid holder 3. The needle mount 8 of the injection needle 2 and the plunger head 6 comprise coupling means which are designed such that they can be unambiguously coupled to one another in order that, after the plunger head 6 has been moved completely into the liquid holder
35 3 in order to discharge liquid 9 which is present in the liquid holder 3 via the outlet opening 4, the injection needle 2, after the plunger head 6 has been coupled to the needle mount 8 of the injection needle 2, can be drawn into the liquid holder 3. As a result, it is no longer easy for the user to be injured by the

injection needle 2 after he has used the injection syringe 1. Reuse of the injection syringe 1 is also prevented. The term "unambiguously" coupled to one another is intended to mean that firm coupling is created, i.e. coupling which is not based on friction or clamping.

In the embodiment shown, the coupling means of the needle mount 8 are designed in the form of a recess 10 with an inwardly directed collar 11. The coupling means of the plunger head 6 are designed in the form of a projecting element 12 with a thickened end 13. The thickened end 13 of the projecting element 12 of the plunger head 6 in this case comprises an outwardly directed collar.

The outlet opening 4 of the liquid holder 3 comprises a narrowed section 14. The narrowed section 14 forms part of the liquid holder 3 and is fixedly connected thereto, thereby contributing to improved sealing of the injection syringe 1. The liquid holder 3 and narrowed section 14 are made from a rigid plastic.

A significant advantage in this context is that the coupling means of the needle mount 8 can be designed in such a way, as also shown in Fig. 1, that they do not extend beyond the narrowed section 14 into the liquid holder 3.

The outlet opening 4 of the liquid holder 3 comprises a blocking means 15 in the transition from the liquid holder 3 to the narrowed section 14. This blocking means 15 is designed to block the needle mount 8 in the outlet opening 4 and can be unblocked when the plunger head 6 is coupled to the needle mount 8 of the injection needle.

In the embodiment shown, the blocking means 15 is to this end designed in the form of a resilient projection which can yield in the direction of the wall of the liquid holder 3 when the plunger head 6 is pressed onto the outlet opening 4.

Fig. 1 also shows a ring 16 made from a hard material, such as metal, and a sealing means 17 with a passage.

When the injection syringe 1 shown in Fig. 1 is in use, the liquid holder 3 will be emptied as a result of the plunger 5 being moved towards the outlet opening 4 with the aid of the plunger rod 7. As a result, the liquid 9 which is present in the liquid holder 3 is forced through the injection needle 2. As soon as the injection syringe 1 has been completely emptied, i.e. when the plunger head 6 has been pressed onto the outlet opening 4, coupling will take place between the projecting element 12 of the plunger head 6 and the needle mount 8. At the same time, the blocking means 15 will be unblocked as a result of the shoulder 18 of the plunger head 6 pushing against the resilient projection.

A favourable aspect in this context is that during coupling of the plunger head 6 and needle mount 8 there is substantially no dead space, so that substantially all the liquid 9 which is present in the liquid holder 3 can be discharged, apart, of course, from any liquid which remains behind in the injection needle 2.

As a result of the plunger head 6 being moved back, i.e. away from the outlet opening 4, with the aid of the plunger rod 7, the needle mount 8 with injection needle 2 is as a result retracted into the liquid holder 3.

Once the injection needle 2 has been retracted into the liquid holder, it will be difficult for it to move out again. The metal ring 16 and the sealing material 17 further reduce the risk of this happening.

Figure 2 shows a diagrammatic cross section through a preferred alternative embodiment of the injection syringe 1 according to the present invention, provided with a protective cap 19. In this case, the injection syringe 1 - unlike in Fig. 1, in which the injection needle 2 has been assembled "through the inside" - is provided with an injection needle 2 which is mounted on the narrowed section 14 (i.e. the injection needle 2 in Fig. 2 is mounted "around the outside"). To this end, the narrowed section

14 is provided with a groove 20, so that as a result the injection need 2 can be stably coupled to the liquid holder 3. In this case, if desired the injection syringe 1 can be designed in such a manner that the needle mount 8 with injection needle 2
5 can no longer be removed from the outlet opening 4 except by being retracted into the liquid holder 3.

It is easy to fit the injection needle 2 to the narrowed section 14 without there being a risk of the coupling means of the
10 needle mount 8 being damaged, as is the case with known retractable injection syringes. In this case, the needle mount 8 (as shown in Fig. 2) preferably does not project beyond the outlet opening 4.

15 Figure 3 shows a diagrammatic cross section through the liquid holder 3 shown in Fig. 2, in which the injection needle 2 which is to be fitted to it has been omitted for the sake of clarity.

A particular aspect of the injection syringe 1 according to the
20 invention is that it is very simple to produce, for example by injection-moulding. For example, the person skilled in the art will quickly realize that the liquid holder 3 as shown in Fig. 3 can be produced without problems.

25 When the injection syringe 1 shown in Fig. 1 or Fig. 2 is in use, the injection syringe 1 will be emptied as a result of the liquid 9 which is present in the liquid holder 3 being forced through the injection needle 2 by the plunger 5 being moved towards the outlet opening 4. When the injection syringe 1 is in
30 its completely empty state, the plunger head 6 of the plunger 5 will have moved into the recess 10 in the needle mount 8. In the process, the thickened end 13 of the projecting element 12 of the plunger head 6 and the inwardly directed collar 11 of the needle mount 8 will interact and provide unambiguous coupling.
35 At the same time, the blocking means 15, which is designed to block the needle mount 8 in the outlet opening 4, so that the needle mount 8 with injection needle cannot inadvertently pass into the liquid holder 3, will be unblocked as a result of, in the embodiment shown, a shoulder 18 of the plunger head 6

pushing against the resilient projection which, as a result, yields in the direction of the liquid-holder wall. If the plunger 5 is then drawn back away from the outlet opening 4 with the aid of the plunger rod 7, the needle mount 8 with injection needle 2 will as a result be drawn into the liquid holder. This prevents the injection needle 2 from being reused. Moreover, this also minimises the risk of injury from the injection needle 2.

Figure 4 shows a perspective view of a preferred embodiment of the needle mount according to the invention. The needle mount 8 connected to the injection needle 2 comprises a recess, which is denoted overall by 10, for receiving the projecting element 12 of the plunger head 6 (cf. Fig. 1). The needle mount 8 is provided with two fingers 21 which yield inwards and of which the sides 22 which face the injection needle 2 form an inwardly directed collar 11 to which the thickened end 13 of the projecting element 12 of the plunger head 6 (cf. Fig. 1) can be uncoupled. As will also be explained in Figures 5-9, the needle mount 8 preferably also comprises means 23 which prevent the needle mount 8 from rotating over the longitudinal axis of the liquid holder 3 when the needle mount 8 is mounted in or on the outlet opening 4 of the liquid holder.

Figures 5 and 8 each show a diagrammatic cross section through alternative embodiments of the injection syringe 1 according to the invention, the injection syringe 1 being provided with means 23 of this type for preventing the needle mount 8 from rotating over the longitudinal axis of the liquid holder 3. The person skilled in the art will understand that the means 23 can be designed in a wide range of ways, provided only that the intended effect is achieved.

In Figure 5, the means 23 are formed by an S-shaped blocking lip on the needle mount 8, which interacts with ribs 24 which are present in the narrowed section 14 of the liquid holder 3 and run parallel to the longitudinal axis of the liquid holder 3. This prevents the needle mount 8 from rotating over the longitudinal axis of the liquid holder 3. When the element 12 is

coupled to the needle mount 8, the top part of the S-shaped blocking lip (which forms the inwardly directed collar 11) will be pressed outward, and at the same time the blocking means 15 will be unblocked, so that the needle mount 8 with injection
5 needle can be retracted into the liquid holder 3.

Figure 6 shows a diagrammatic partial view of the narrowed section 14 shown in Fig. 5. The inwardly projecting ribs 24 are clearly visible in this figure.

10

Figure 7 shows a plan view of a cross section through the narrowed section 14 from Fig. 6, in which the ribs 24 are shown in a different way. It will be obvious that as an alternative to the six ribs 24 shown, it is possible to use any other suitable
15 number.

In Figure 8, the rotation-preventing means 23 are designed as a protruding projection which is moved inwards when the needle mount 8 and the element 12 are coupled. In this very
20 sophisticated embodiment, the means 23 functions as both a rotation-preventing means for the needle mount and as a blocking means 15 for blocking the needle mount 8 in the outlet opening 4. In the embodiment shown, therefore, the means 23 has three functions: 1) preventing rotation of the injection needle 2 over
25 the longitudinal axis of the liquid holder 3; 2) blocking the needle mount 8 in the outlet opening 4 of the liquid holder 3 during injection (in this case, therefore, the means 23 carries out the function of the blocking means 15 in, for example Fig. 2); and 3) allowing unambiguous coupling to the thickened
30 end 13 of the projecting element 12 of the plunger head 6 after the liquid holder 3 has been emptied (in this case, the means 23 is fulfilling the function of the inwardly directed collar 11 in, for example, Fig. 2).

35 Figure 9 shows a plan view of a cross section through the narrowed section 14 shown in Fig. 8. The person skilled in the art will quickly recognize that as a result of the element 12 of the plunger head 6 introduced into the rotation-preventing means 23 (i.e. when the element 12 of the plunger head 6 is coupled to

the means 23), the means 23 will be deformed in such a manner that rotation of the needle mount 8 is no longer prevented. Moreover, the blocking means 15 is unblocked as a result, so that the injection needle 2 can be retracted into the liquid
5 holder 3.

CLAIMS

1. Injection syringe (1) having a retractable injection needle (2), at least comprising:
- 5 - a liquid holder (3) having an outlet opening (4);
 - a plunger (5), which can be displaced inside the said liquid holder (3) and has a plunger head (6), to which a plunger rod (7) is or can be secured;
 - 10 - an injection needle (2) with needle mount (8), which is or can be mounted in or on the outlet opening (4) of the liquid holder (3);
- the needle mount (8) of the injection needle (2) and the plunger head (6) comprising coupling means which are designed such that they can be coupled unambiguously to one another in order that,
- 15 after the plunger head (6) has been moved completely into the liquid holder (3) in order to discharge liquid (9) present in the liquid holder (3) via the outlet opening (4), the injection needle (2), after the plunger head (6) has been coupled to the needle mount (8) of the injection needle (2), can be drawn into
- 20 the liquid holder (3);
- the coupling means of the needle mount (8) being designed in the form of a recess (10) with an inwardly directed collar (11), and the coupling means of the plunger head (6) being designed in the form of a projecting element (12) with a thickened end (13); and
- 25 the outlet opening (4) of the liquid holder (3) comprising a blocking means (15) which is designed to block the needle mount (8) in the outlet opening (4), which blocking means (15) can be unblocked when the plunger head (6) is coupled to the needle mount (8) of the injection needle (2).
- 30
2. Injection syringe according to claim 1, wherein the thickened end (13) of the projecting element (12) of the plunger head (6) comprises an outwardly directed collar.
- 35
3. Injection syringe according to claim 1 or 2, wherein the outlet opening (4) of the liquid holder (3) is designed in the form of a narrowed section (14).
4. Injection syringe according to one or more of the preceding

claims, wherein the blocking means (15) is designed in the form of one or more resilient projections which can yield in the direction of the wall of the liquid holder (3) when the plunger head (6) is pressed onto the outlet opening (4).

5

5. Injection syringe according to one or more of the preceding claims, wherein the needle mount (8) is provided with one or more fingers (21) which yield inwards.

10

6. Injection syringe according to one or more of the preceding claims, wherein the liquid holder (3) is made from a rigid material.

15

7. Injection syringe according to one or more of the preceding claims, wherein the injection syringe (1) comprises means (23) for preventing the needle mount (8) from rotating over the longitudinal axis of the liquid holder (3) when the needle mount (8) is mounted in or on the outlet opening (4) of the liquid container (3).

20

8. Injection syringe according to claim 7, wherein the means (23) are formed by a protruding projection on the needle mount (8) which can be deformed when the plunger head (6) is coupled to the needle mount (8), all this in such a manner that rotation of the needle mount (8) over the longitudinal axis of the liquid holder (3) becomes possible.

9. Injection syringe according to claim 8, wherein the projection extends over substantially the entire length of the needle mount (8).

10. Injection syringe according to one or more of claims 7-9, wherein the means (23) also form the blocking means (15).

11. Needle mount (8) clearly intended for an injection syringe according to one or more of the preceding claims 1-10.

12. Needle mount according to claim 11, which needle mount is provided with means (23).

13. Plunger head (6) clearly intended for an injection syringe according to one or more of the preceding claims 1-10.

5 14. Liquid holder (3) clearly intended for an injection syringe according to one or more of the preceding claims 1-10.

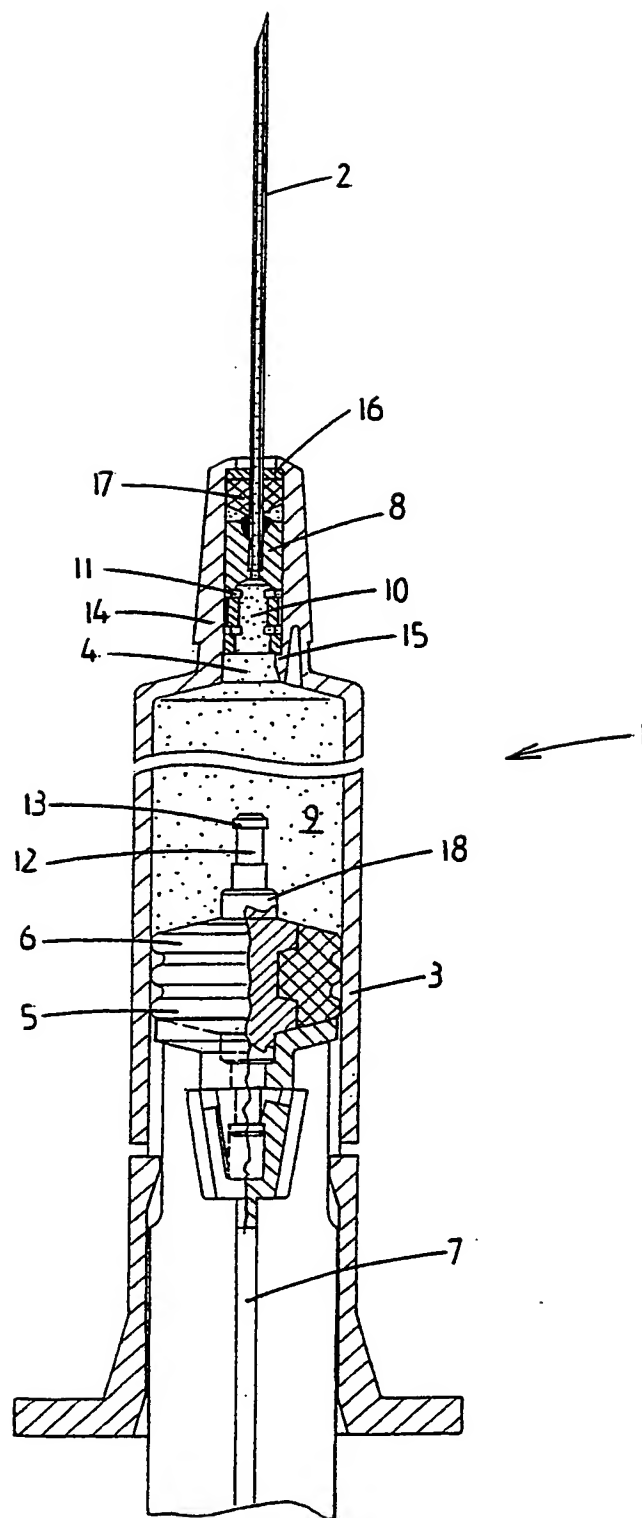


Fig. 1

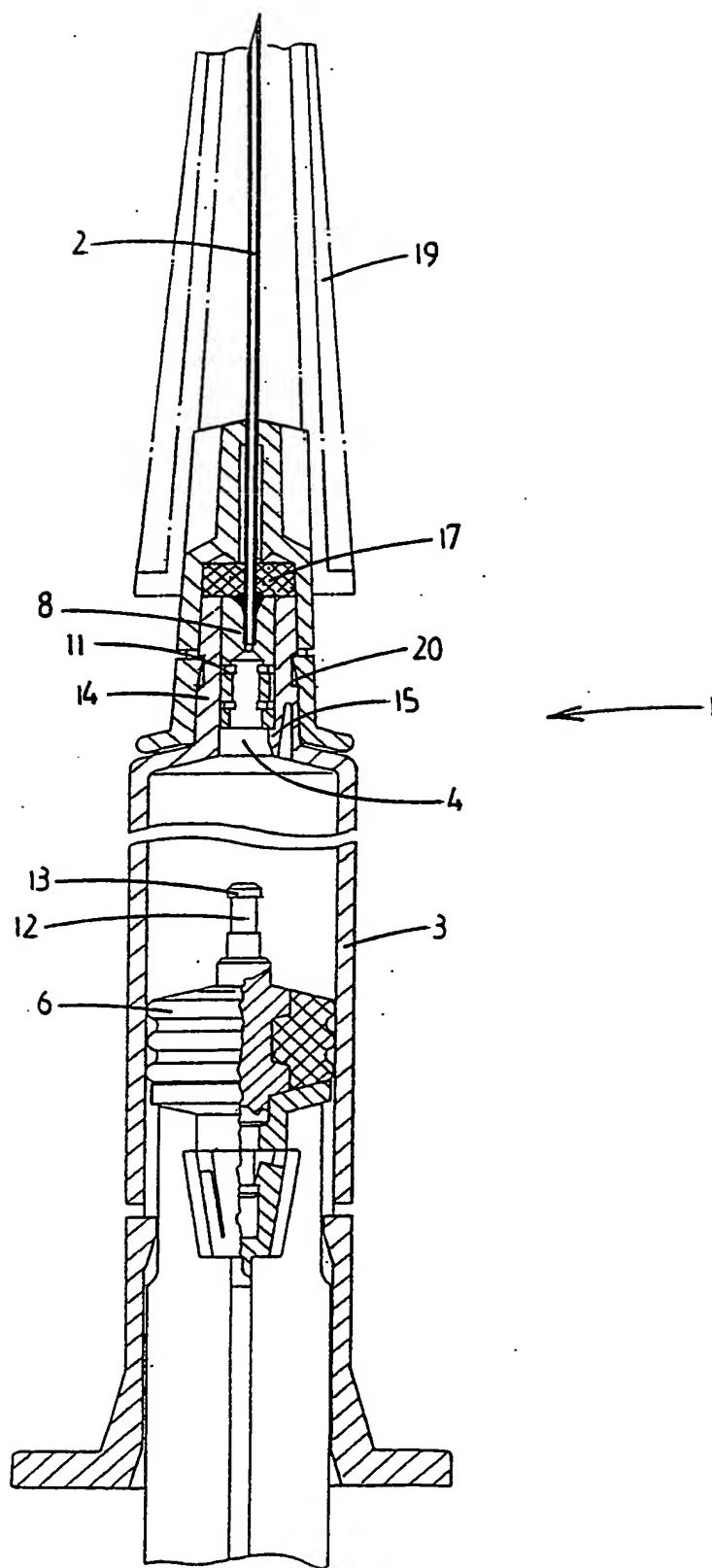


Fig. 2

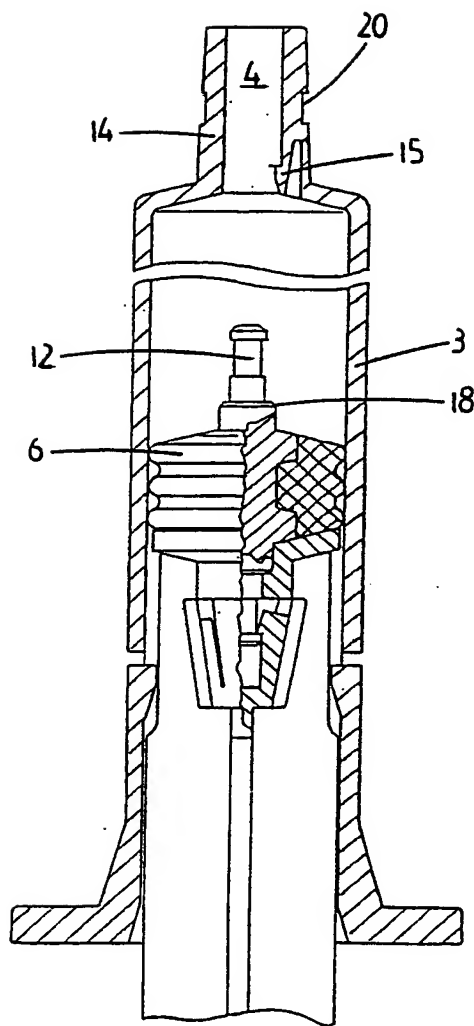


Fig. 3

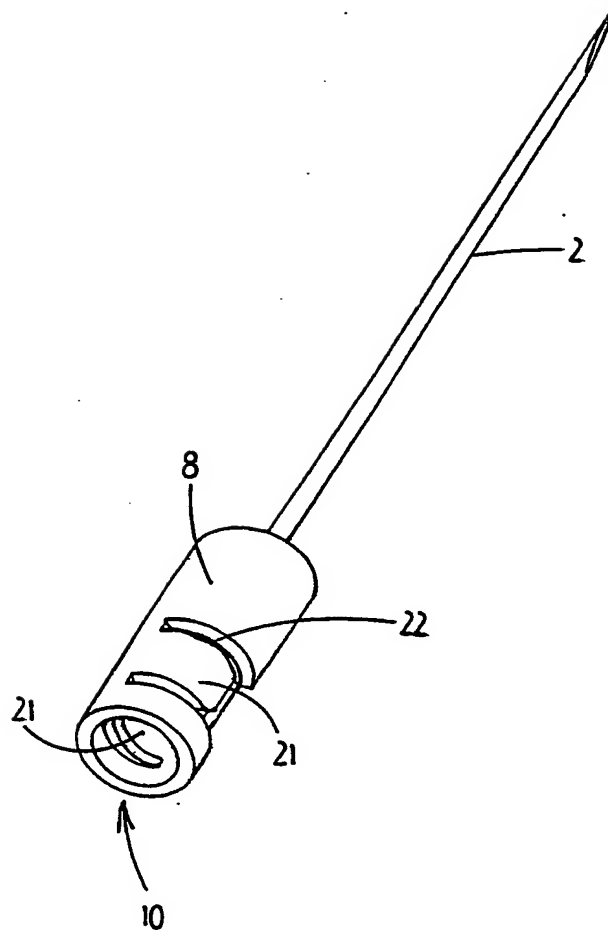


Fig. 4

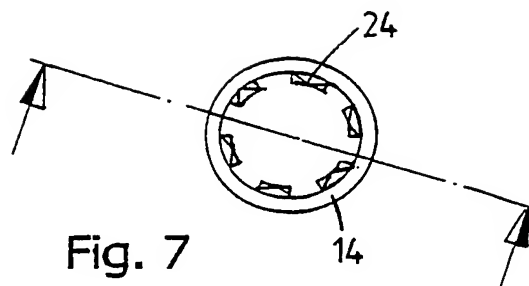


Fig. 7

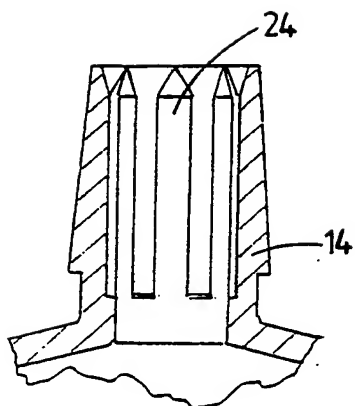


Fig. 6

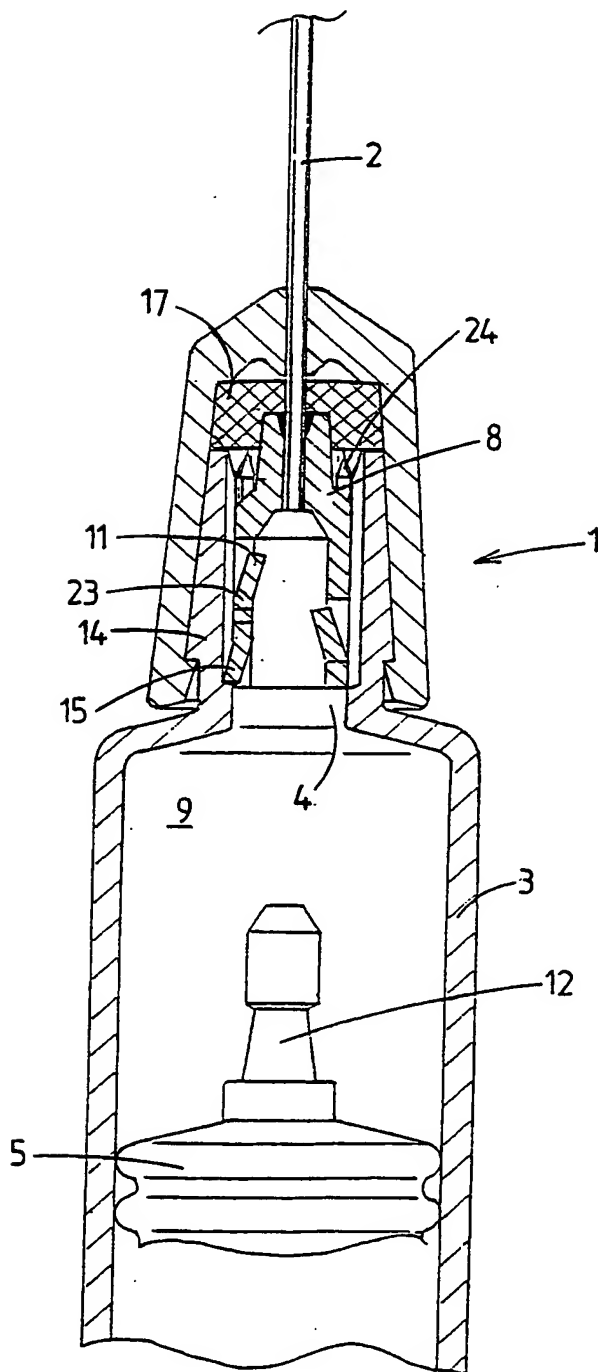


Fig. 5

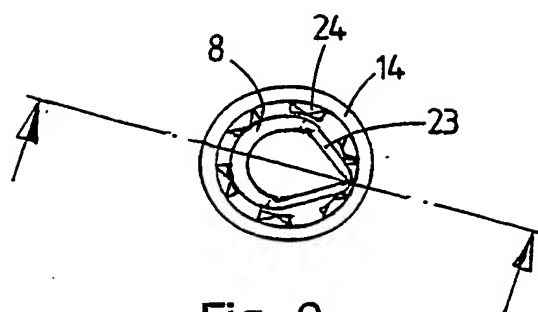


Fig. 9

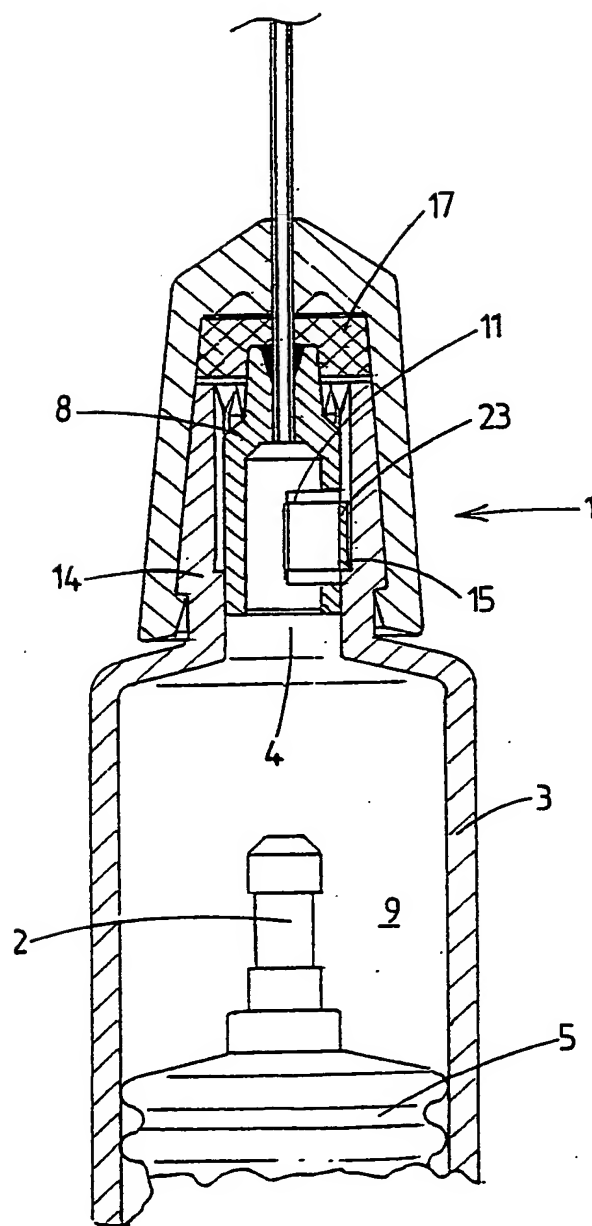


Fig. 8

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61M5/50 A61M5/32 A61M5/34

B. FIELDS SEARCHED

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